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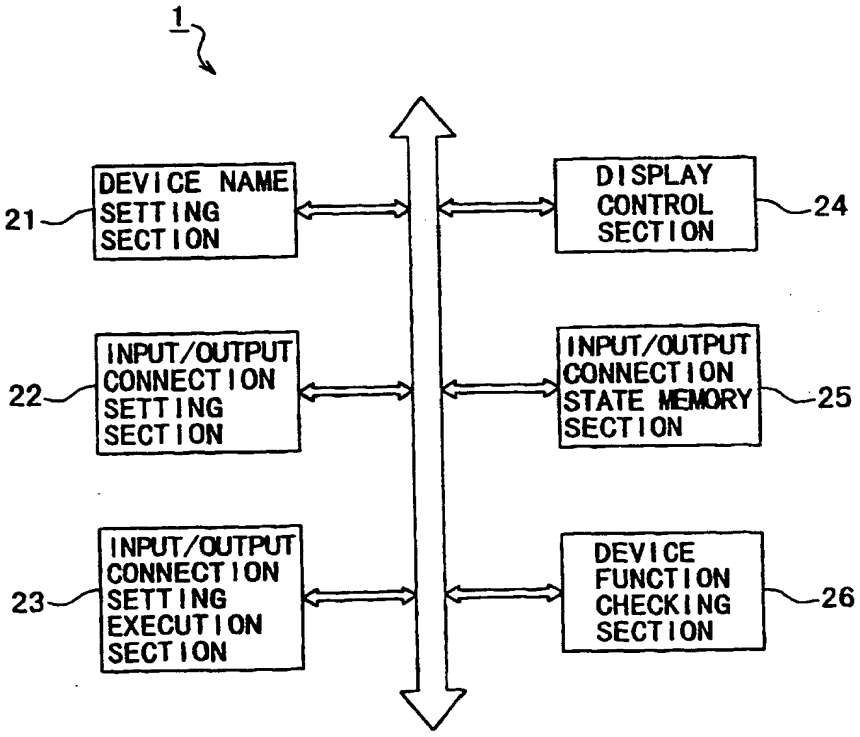
(57) Abstract

An apparatus and method for connecting a number of information processing apparatuses together in a desired manner in which each information processing apparatus is connected to a network. Signals may be formed which represent a graphical interface for display on a display unit. Such graphical interface may indicate available connections between the information processing apparatuses connected to the network. A user may select a desired connection by use of the graphical interface, whereupon a control signal may be formed therefrom. The desired connection between the corresponding information processing apparatuses may be established in accordance with the control signal. As a result, an input/output connection setting or settings of information processing apparatuses coupled to a network may be easily performed.



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DESCRIPTION

METHOD AND APPARATUS FOR SETTING CONNECTIONS BETWEEN A NUMBER OF INFORMATION PROCESSING APPARATUSES

TECHNICAL FIELD

The present invention relates to a connection setting apparatus and method and, more particularly, to such apparatus and method wherein a data input/output connection setting or settings between a number of information apparatuses connected to a network can be easily performed.

BACKGROUND ART

A number of information processing apparatuses, including video tape recorders (VTRs) having a digital interface, integrated type digital VTRs, hard disk drives (HDDs) for recording image and sound data, and Mini Disk (trademark) (MD) devices may be arranged in a number of different arrangements. Such products may be capable of one-to-one connections between two devices and may be incapable of an expandable or multiple-type of connection arrangement.

However, other information processing apparatuses may have a digital interface operable in accordance with a predetermined standard, such as an IEEE 1394 protocol, such that a plurality of information processing apparatuses can be connected. In such arrangement, data may be transmitted between any two of the plurality of information processing apparatuses connected to an IEEE 1394 serial bus by selecting a predetermined one of these apparatuses. However, for data input/output between information processing apparatuses having such digital interface which may be freely selected, a connection setting operation may need to be

performed in each of the information processing apparatuses. Performing such connection setting operation may be time consuming and/or troublesome for the user.

Television receivers, personal computers, network terminals and/or the above-mentioned information processing apparatuses may be connected by use of a digital interface so as to form a home network. In such home network, if a user wishes to connect a plurality of the devices so as to enable data transfer between desired ones of such devices, the user may have to perform the above-mentioned time consuming and/or troublesome setting operation.

DISCLSURE OF THE INVENTION

An object of the present invention is to enable an information processing apparatus coupled to a network having a plurality of information processing apparatuses coupled thereto to be operated so as to perform input/output connection setting 42 of the other information processing apparatuses connected to the network.

In accordance with an aspect of the present invention, an apparatus is provided for connecting a number of information processing apparatuses together in a desired manner in which each information processing apparatus is connected to a digital bus. The apparatus comprises a device for generating a signal representative of a graphical interface for display on a display unit which indicates any available connections between the information processing apparatuses connected to the digital bus, a device for receiving signals from a user indicative of a desired connection selected from among the available connections indicated on the graphical interface and for forming a control signal therefrom, and a device for generating a signal for causing the desired connection between the corresponding information processing apparatuses to be established in accordance with the control signal.

In accordance with another aspect of the present invention, an apparatus is provided for connecting a number of information processing apparatuses together in a desired manner in which each information processing apparatus is connected to a digital bus. The apparatus comprises a device for generating a signal representative of a graphical interface for display on a display unit which indicates the information processing apparatuses connected to the digital bus; a device for receiving a desired connection signal indicative of a desired connection between corresponding information processing apparatuses and for forming a control signal therefrom, in which the desired connection signal is obtained from an input provided by a user with the use of the graphical interface; and a device for generating a signal for causing the desired connection between the corresponding information processing apparatuses to be established in accordance with the control signal.

Other objects, features and advantages according to the present invention will become apparent from the following detailed description of illustrated embodiments when read in connection with the accompanying drawings in which corresponding components are identified by the same reference numerals.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram of a system in accordance with an embodiment of the present invention;

Fig. 2 is a diagram of a connection manager of the system of Fig. 1;

Fig. 3 is a functional diagram of the connection manager of Fig. 2;

Fig. 4 is a diagram of a cycle structure of data transmission between devices connected in accordance with IEEE 1394;

Fig. 5 is a diagram to which reference will be made in explaining a structure of address space of CSR architecture;

Fig. 6 is a diagram to which reference will be made in explaining locations, names and functions of essential CSRs;

Fig. 7 is a diagram of a ROM format;

Fig. 8 is a diagram of "bus_info_block", "root_directory" and "unit_directory";

Fig. 9 is a diagram of an arrangement of plug control registers (PCRs);

Figs. 10A to 10D are diagrams of configurations for oMPR, oPCR, iMPR, and iPCR;

Fig. 11 is a diagram of plugs, plug control registers and isochronous channels;

Fig. 12 is a flowchart to which reference will be made in explaining an input/output setting operation;

Fig. 13 is a diagram of an arrangement of an ID-device table;

Fig. 14 is a diagram of an arrangement of a node-ID table;

Fig. 15 is a diagram of a graphic interface for input/output connection designation;

Fig. 16 is a flowchart to which reference will be made in explaining an operation for checking whether a device conforms to IEC 61883;

Fig. 17 is a flowchart to which reference will be made in explaining an input/output connection operation;

Fig. 18 is a flowchart to which reference will be made in explaining a cancellation of input/output connection operation;

Fig. 19 is a diagram of a graphic interface for input/output connection designation which indicates that a VTR and a set-top box cannot be connected to each other due to a difference in signal formats;

Fig. 20 is a diagram of a graphic interface for input/output connection designation; and

Fig. 21 is a diagram of an arrangement of an ID-name table.

BEST MODE FOR CARRYING OUT THE INVENTION

An embodiment of the present invention will now be described.

Fig. 1 illustrates a network 99 having a connection manager 1, an HDD 4, a VTR 5, an integrated digital video camera/recorder 6, and a set-top box 7 which are connected to each other by buses 9-1 to 9-4 which may be IEEE 1394 serial buses. That is, in the network 99, a digital interface in accordance with IEEE 1394 may be used for connecting these information processing apparatuses.

A remote controller 2 is adaptable to receive input commands from a user by use of crisscross keys or ten cluster keys contained on the remote controller and to transmit an infrared light signal corresponding thereto. The connection manager 1 may receive the infrared light signal transmitted from the remote controller 2 and control the information processing apparatuses or devices connected to the network 99 in accordance with an input/output connection command represented by the received light signal. Additionally, the connection manager 1 may supply an output signal to a monitor 3 so as to cause information to be displayed thereon such as information pertaining to the kinds and/or the names of the manufacturers of the devices connected to the network 99, information about a data format

usable by the devices, information indicating the state of an input/output connection(s) between the devices, and so forth.

The devices shown in Fig. 1 may form or be considered nodes or accessible units in accordance with a prescription of IEEE 1394 and in accordance with IEC 61883 prescribing audio visual (AV) data transmission on IEEE 1394. In other words, devices which do not conform to a predetermined standard such as IEC 61883 may not be controlled by the connection manager 1.

Fig. 2 illustrates internal sections of the connection manager 1. An infrared signal receiving section 11 may receive the infrared light signal transmitted from the remote controller 2, demodulate the received infrared light signal to obtain a control signal, and transfer the control signal to a central processing unit (CPU) 12 via an internal bus 18. The CPU 12 may determine control contents based on a program stored in a read-only memory (ROM) 16 from the control signal and information stored in a random-access memory (RAM) 13 about the states of the devices connected by IEEE 1394, and may control the connected devices through an interface 14.

The ROM 16 may have stored therein the program used by the CPU 12 and fixed data which may be utilized in calculation parameters. The RAM 13 may have stored therein parameters of the program used by the CPU 12, parameters of the states of the devices connected by IEEE 1394, and so forth, which may be suitably changed during the execution of the program. The interface 14 may be an input/output interface in accordance with IEEE 1394 to which the IEEE 1394 serial buses 9-1 and 9-3 are connected.

A monitor control section 15 may receive data from the CPU 12 or stored data from the RAM 13, may convert the same into a video signal, and may supply the video signal to the monitor 3 so as to be displayed thereon. An electrically erasable programmable

read-only memory (EEPROM) 17 may be utilized to store company names and device names corresponding to company identification codes (IDs) and chip IDs, and other information which should be stored even after power is turned off.

Functional sections of the connection manager 1 realized when the CPU 12 executes the above-mentioned program are illustrated in Fig. 3. A device name setting section 21 may set names previously stored or inputted by a user to the devices identified with node identification codes (IDs) connected to the network 99. An input/output connection setting section 22 may input settings of input/output connections of the devices connected to the network 99. An input/output connection setting execution section 23 may execute a setting of input/output connections of the devices connected to the network 99 based on the device input/output connection setting inputted by the input/output connection setting section 22. A display control section 24 may cause to be displayed on the monitor 3 information needed from a user to input a necessary or respective setting, such as information pertaining to the state of input/output connections of the devices connected to the network 99. An input/output connection state memory section 25 may store therein information pertaining to the state of input/output connections of the devices connected to the network 99. A device function checking section 26 may ascertain whether each of the devices connected to the network has a predetermined function such as a function operable in accordance with IEC 1883.

A cycle structure of data transmission between the devices connected in accordance with IEEE 1394 is illustrated in Fig. 4. As indicated therein, in IEEE 1394, data may be divided into packets and transmitted in a time division manner based on a cycle of 125 ms. Such cycle may be produced by a cycle start signal supplied from a node having a cycle master function (which may be one of the devices shown in Fig. 1). A band or time unit for transmission of isochronous packets may be secured from the start of each cycle. In

isochronous transmission, data may be transmitted in a certain time period, however, transmitted data may be lost if a transmission error occurs since no procedure for protecting or recovering the data is provided. During the time period in each cycle in which isochronous communication is not performed, some of the nodes which have secured the bus as a result of arbitration may transmit asynchronous packets. In asynchronous transmission, an acknowledgement signal may be sent to the transmitting device to acknowledge receipt of the data and, in the absence thereof, the transmitting device may re-send the data. Alternatively, if data has not been properly received, the receiving device may send a retry signal to the transmitting device whereupon the transmitting device may re-send the data. As a result, reliable data transmission may be provided. However, in asynchronous transmission, transmission timing may not be constant.

If certain nodes perform isochronous transmission, these nodes should be compatible with an isochronous function and at least one of such nodes should have a cycle master function. Further, at least one of the nodes connected to the IEEE 1394 serial buses 9-1 to 9-4 should have an isochronous resource manager function.

IEEE 1394 conforms to the control and status register (CSR) architecture which has a 64-bit address space and which is prescribed in ISO/IEC13213 or ANSI/IEEE1212. The structure of the CSR architecture address space is illustrated in Fig. 5. In such structure, the upper 16 bits form a node ID representing one of the IEEE 1394 nodes and the other 48 bits are used to designate address space assigned to the node. The upper 16 bits are separated into a bus ID of 10 bits and a physical or node ID of 6 bits. Since the case in which all of the bits are set to 1 is reserved for a special purpose, 1023 buses and 63 nodes can be designated.

In the 256 terabyte address space prescribed with the lower 48 bits, the space prescribed with the upper 20 bits is divided into an initial register space used for registers

specific to 2048-byte CSRs, registers specific to IEEE 1394, and the like, a private space, an initial memory space, and so forth, while the space prescribed with the lower 28 bits is used as a configuration read-only memory (ROM), an initial unit space for use specific to the nodes, plug control registers (PCRs), such as defined in IEC 61883, and so forth, if an initial register space is prescribed with the upper 20 bits.

Offset addresses, names and functions of essential CSRs are illustrated in Fig. 6. The offsets shown in Fig. 6 are addresses offset from address FFFFF0000000h (in which "h" denotes hexadecimal notation) from the start of the initial register space.

A bandwidth available register having offset 220h indicates a band assignable to isochronous communication. Only the value of the bandwidth available register with respect to the node operating as an isochronous resource manager is valid. That is, each node may have the CSRs shown in Fig. 5, but only the bandwidth available register of the isochronous resource manager may be effective. In other words, basically, only the isochronous resource manager has the bandwidth available register. In the bandwidth available register, a maximum value may be stored when no band is assigned for isochronous communication and the value may be reduced each time a band is assigned.

Channel available registers having offsets 224h to 228h respectively have bits corresponding to channel numbers 0 to 63. A bit having a value of zero may indicate that the corresponding channel has been assigned. Only the channel available registers of the node operating as an isochronous resource manager are effective.

Returning to Fig. 5, a configuration ROM based on a read-only memory (ROM) format is placed or arranged from address 400h to address 800h. An example of such ROM format is illustrated in Fig. 7. Each of the nodes which is an access unit on IEEE 1394 can contain a plurality of units which operate independently while using the address space in

common. "Unit_directories" may designate software version or locations with respect to these units. Although the locations of "bus_info_block" and "root_directory" may be fixed, the locations of the other blocks may be designated by offset addresses.

Details of the "bus_info_block", "root_directory" and "unit_directory" are illustrated in Fig. 8. An ID number indicating a manufacturer of a device may be stored in "Company_ID" of the "Bus_info_block". An ID unique to the device (which is only assigned to the respective device) may be stored in "Chip_ID" of the "Bus_info_block". For a device conforming to the IEC 61883 standard, in "unit_spec_id" of the "Unit_directory", "00h" is written as the first octet, "A0h" is written as the second octet, and "2Dh" is written as the third octet. Further, in "unit_sw_version", "01h" is written as the first octet and "1" is written as the least significant bit (LSB) of the third octet.

For device input/output control through the interface, each node has plug control registers (PCRs) with addresses 900h to 9FFh in the initial unit space shown in Fig. 5. This may be substantiation of the "plug" concept for formation of a signal path logically analogous to an analog interface. An arrangement of the PCRs is illustrated in Fig. 9. As shown therein, the PCRs may include an output plug control register (oPCR) representing an output plug, an input plug control register (iPCR) representing an input plug, an output master plug register (oMPR) and an input master plug register (iMPR) indicating information about output and input plugs specific to the device. Each device may have a single oMPR and a single iMPR, but may have a plurality of oPCRs and a plurality of iPCRs corresponding to the plugs according to the capacity of the device. In the arrangement of Fig. 9, there are thirty one oPCRs and thirty one iPCRs. The flow of isochronous data may be controlled by operating the registers corresponding to the plugs.

Configurations of oMPR, oPCR, iMPR, and iPCR are respectively illustrated in Figs. 10A-10D.

A code indicating the maximum transmission rate at which the corresponding device can transmit or receive data may be stored in the 2-bit "data rate capability" portion located in the most significant bit (MSB) side of the oMPR and iMPR. The number of a channel used for a broadcast output may be stored in the 6-bit "broadcast channel base" of the oMPR. A value indicating the number of output plugs of the device (that is, the number of oPCRs) may be stored in the 5-bit "number of output plugs" on the LSB side of the oMPR. A value indicating the number of input plugs of the device (that is, the number of iPCRs) may be stored in the 5-bit "number of input plugs" on the LSB side of the iMPR. The 3-bit reserved portion and the 8-bit "non-persistent extension field" and 8-bit "persistent extension field" are reserved or defined for future use.

The 1-bit "on-line" portion on the MSB side of the oPCR and the iPCR may indicate the state of use of the plug. For example, a value of 1 may indicate an ON-LINE state of the plug, and a value of 0 may indicate an OFF-LINE state of the plug. The 1-bit "broadcast connection counter" of the oPCR and the iPCR may indicate a broadcast connection state. For example, a value of 1 may indicate a broadcast connection exists and a value of 0 may indicate a broadcast connection does not exist. The 6-bit "point-to-point connection counter" of the oPCR and the iPCR may indicate the number of point-to-point connections of the plug. The 6-bit "channel number" of the oPCR and the iPCR may indicate the number of an isochronous channel to which the plug is connected. The 2-bit "data rate" portion of the oPCR may indicate the actual transmission rate of isochronous data packets supplied from the plug. A 4-bit "overhead ID" portion of the oPCR may have a code stored therein which indicates an overhead bandwidth for isochronous communication. The 10-bit "payload" portion of the oPCR may

indicate the maximum value of data which may be contained in isochronous packets and/or which may be handled by the plug. The reserved portions are reserved for future or other use.

Fig. 11 illustrates a relationship between plugs, plug control registers and isochronous channels. As shown therein, AV-devices 31-1 to 31-3 are connected to each other by a IEEE 1394 serial bus. The AV-device 31-3 may supply isochronous data to channel #1 of the IEEE 1394 serial bus which was designated by oPCR[1] of oPCR[0], oPCR[1] and oPCR[2], which are prescribed with respect to the number and the transmission rate with the oMPR of the AV-device 31-3. The AV-device 27-1 may read the isochronous data supplied to designated channel #1 of the IEEE 1394 serial bus through iPCR[0] of iPCR[0] and iPCR[1] which are prescribed with respect to the number and the transmission rate with the iMPR of the AV-device 31-1. Similarly, the AV-device 31-2 may supply isochronous data to channel #2 which was designated by oPCR[0], and the AV-device 31-1 may read the isochronous data from designated channel #2 through iPCR[1].

An input/output connection setting operation for a device connected to the network 99 having the connection manager 1 and other devices in accordance with a number of predetermined standards (such as IEEE 1394 and IEC 61883) will now be described with reference to Fig. 12. As previously indicated, the connection manager 1 may include the device name setting section 21 (Fig. 3). Such section may have stored therein a previously formed ID-device table which may indicate company IDs, chip IDs, and names of the devices connected to the network. An example of an arrangement of the ID-device table is illustrated in Fig. 13.

In step S11, a user may connect a device to the network 99 using a cable in accordance with a predetermined standard (IEEE 1394 serial bus).

Processing may proceed to step S12 wherein bus resetting may be automatically performed by a bus initialization function in the physical layer of each node so as to execute a bus reconfiguration. With such reconfiguration, a node ID is reassigned to each node.

In step S13, the device function checking section 26 (Fig. 3) may determine whether the newly connected device conforms to a predetermined standard such as IEC 61883 or IEC1883.

Thereafter, processing may proceed to step S14 wherein the device name setting section 21 (Fig. 3) may successively read out the company IDs and chip IDs of the nodes to form a node-ID reference table of the company IDs, the chip IDs, and the node IDs of the nodes. An example of such node-ID reference table having company IDs, chip IDs, and node IDs of the nodes is illustrated in Fig. 14.

Processing may then proceed to step S15 wherein the device name setting section 21 may form an ID-device reference table of the company IDs, the chip IDs and the device names.

In step S16, the display control section 24 (Fig. 3) may read out the name of the newly connected device from the device name setting section 21 and may cause such name to be displayed on the monitor 3. Upon viewing such display, the user may, if necessary, revise or input the name of the device to the device name setting section 21 by operation of the remote controller 2. This new input may be recorded in the ID-device table.

In step S17, the user may input a command to perform an input/output connection setting operation by use of the remote controller 2 (Fig. 1). As a result, the input/output connection setting input section 22 (Fig. 3) may cause a graphic interface for an input/output connection designation to be displayed on the monitor 3. While observing such displayed graphic interface, the user may input a desired input/output connection setting by

operating the remote controller 2. Such connection setting may conform to a predetermined standard, such as IEC 61883.

In step S18, the input/output connection setting execution section 23 (Fig. 3) may perform processing pertaining to an input/output connection or cancellation of a predetermined one of the nodes based on an input/output connection setting instruction obtained in step S17. The state of the network 99 after execution of such processing pertaining to the input/output connection or cancellation of the predetermined node may be stored in the input/output connection memory section 25 (Fig. 3).

Therefore, in the present invention, a connection setting for any or all of the devices of a network may be performed by use of the connection manager 1 as described above. As is to be appreciated, by using the present invention, a desired connection setting(s) of a device(s) may be performed without operating the respective device(s).

An example of a graphic interface of the input/output connection designation of step S17 (Fig. 12) is illustrated in Fig. 15. Cells 30-1 to 30-4 arranged in the uppermost horizontal row represent the output plugs of several devices (such as a camera/recorder, a set top box, a video tape recorder, and hard disk drive). Cells 32-1 to 32-4 in the leftmost column represent the input plugs of the devices. The cell located at the intersection of the column containing one of the output plug cells and the row containing one of the input plug cells represents the state of connection between the respective output plug and the respective input plug, wherein single cross-hatching, shading or the like in a cell may indicate a connection between corresponding plugs and the absence thereof may indicate that such connection has not been established. For example, cell 34 represents the state of connection between the output plug of the set-top box 7 and the input plug of the VTR 5. In the arrangement shown in Fig. 15, cell 34 indicates that the output plug of the set-top box 7 is connected to the input plug of the

VTR 5. As another example, cell 35 represents the state of connection between the output plug of the HDD 4 and the input plug of the camera/recorder 6 and, in the arrangement shown in Fig. 15, cell 35 indicates that the output plug of the HDD 4 is connected to the input plug of the camera/recorder 6.

In the graphic interface example of Fig. 15, the empty cells indicate that the respective connection is possible but has not been established. Further, the double cross-hatching in a cell indicates that a connection between the corresponding plugs may not be possible. As such, in the example of Fig. 15, since the devices appear in the same order from left to right in the horizontal row of output plug cells and as from top to bottom in the vertical column of input plug cells, the resulting display is a diagonal line between the left top corner and the right bottom corner of double cross-hatching which indicates that corresponding connections may not be possible.

An operation of the device function checking section 26 (Fig. 3) for determining whether a device conforms to predetermined standard such as IEC 61883 will now be described with reference to Fig. 16. For a device conforming to the IEC 61883 standard, in "unit_spec_id" of "unit_directory", "00h" may be written as the first octet, "A0h" may be written as the second octet, and "2Dh" may be written as the third octet. Further, in "unit_sw_version" for the device conforming to IEC 1883, "01h" may be written as the first octet and "1" may be written as the LSB of the third octet. From such values, it may be possible to determine whether a device conforms to IEC 1883.

In step S21, the device function checking section 26 may read "unit_spec_id" and "unit_sw_version" in "unit_directory" for a newly connected device. Processing may then proceed to step S22.

In step S22, the device function checking section 26 may determine whether the first to third octets of "unit_spec_id" are 00h, A0h, and 2Dh, respectively, and whether the first octet and the LSB of the third octet of "unit_sw_version" are 01h and 1, respectively. If the result of such determination is affirmative (that is, that the first to third octets of "unit_spec_id" are 00h, A0h, and 2Dh, respectively, and that the first octet and the LSB of the third octet of "unit_sw_version" are 01h and 1, respectively), processing may proceed to step S23.

In step S23, the device function checking section 26 may read out the number of output plugs and the number of input plugs of the newly connected device. Thereafter, the processing may be terminated. Alternatively, step 23 may be omitted, whereupon if the result of the determination of step S22 is affirmative, processing may be terminated.

If the result of the determination in step S22 is negative, processing may proceed to step S24. In step S24, processing for a device which does not conform to IEC 61883 may be performed.

Based on the above-described processing, the connection manager 1 may perform input/output setting operations exclusively for the devices conforming to IEC 61883 and having plug control registers.

An operation for providing input/output connections in step S18 (Fig. 12) by the input/output connection setting execution section 23 (Fig. 3) will now be described with reference to Fig. 17.

In step S31, the input/output connection setting execution section 23 demands or requests that the node operating as an isochronous manager (for example, set-top box 7) acquire an isochronous communication channel. In response to such demand, the node operating as an isochronous manager sets "0" for the bit of the channel available register(s) in the CSRs which corresponds to an unoccupied channel(s). Processing may then proceed to step S32.

In step S32, the input/output connection setting execution section 23 demands that the node operating as an isochronous manager acquire a necessary isochronous communication band or time period. In response to such demand, the node operating as an isochronous manager subtracts the value of the demanded band from the value of the bandwidth available register in the CSRs. Processing may then proceed to step S33.

In step S33, the input/output connection setting execution section 23 causes the input device designated by the user in step S17 (Fig. 12) to select an unused one of the iPCRs (iPCR[j]), to set the number of the isochronous channel to be used (that is, the number of the channel acquired in step S31) in the iPCR[j], and to set "1" in the point-to-point connection counter (Fig. 10).

In step S34, the input/output connection setting execution section 23 causes the output device designated by the user to select an unused one of the oPCRs (oPCR[k]), to set in the oPCR[k] the same isochronous channel number as that set in the iPCR[j], and to set "1" in the point-to-point connection counter.

Upon securing the channel, band, and output and input plugs as described above, data may be transmitted from the output plug of the designated output device to the input plug of the designated input device by using the secured channel and band.

An operation of input/output connection cancellation processing performed by the input/output connection setting execution section 23 (Fig. 3) after the completion of data transmission will now be described with reference to Fig. 18.

In step S41, the input/output connection setting execution section 23 may clear the "channel number" and "point-to-point connection counter" of oPCR[k] of the output device designated by the user so as to release or place the oPCR[k] in an unused or available state. Processing may then proceed to step S42.

In step S42, the input/output connection setting execution section 23 clears "channel number" and "point-to-point connection counter" of iPCR[k] of the input device designated by the user to release or place the iPCR[k] in an unused or available state. Processing may then proceed to step S43.

In step S43, the input/output connection setting execution section 23 demands that the node operating as an isochronous resource manager set free the necessary isochronous communication band. In response to this demand, the node operating as an isochronous resource manager adds a predetermined value according to the band to be set free to the value of the bandwidth available register in the CSRs. Processing may then proceed to step S44.

In step S44, the input/output connection setting execution section 23 demands that the node operating as an isochronous resource manager set free the isochronous communication channel. In response to this demand, the node operating as an isochronous resource manager may set the bit corresponding to the channel available registers in the CSRs to a value of "1". Thereafter, processing may be terminated.

When performing the checking processing of step S13 (Fig. 12), the device function checking section 26 (Fig. 3) may inquire or request of the plug of each device an outputtable signal format by the Input/Output Plug Signal Format Command in the AV/C Digital Interface Command Set in a predetermined standard (such as IEC 61883). If the obtained signal format information indicates different formats between a number of devices, the connection manager 1 may cause a notice to be provided to the user which advises the user not to establish a connection between the respective iPCRs and oPCRs thereof or may prevent the user from selecting a connection therebetween by use of the graphic interface for input/output connection designation on the monitor 3. Fig. 19 illustrates an example of a graphic interface for input/output connection designation in which the user is advised that the VTR 5 and the

set-top box 7 cannot be connected to each other due to a difference in signal formats or non-compliance with a predetermined standard or the like. (See double cross-hatching in cells 97 and 98.)

Although indicated in Fig. 19 with double cross-hatching, cells for indicating that a connection may not be established due to a difference in signal formats, non-compliance with a predetermined standard and so forth may be displayed in a color different from that of the other cells. Alternatively, other arrangements may be utilized to differentiate between cells which indicate that a connection may not be establish and those which indicate that a connection may be establish.

Another example of a graphic interface for input/output connection designation is illustrated in Fig. 20. In this example, icons and names of devices may be displayed. By use of this display, the user may input an instruction for a desired connection between devices by performing a mouse-type operation which may be similar to a connection operation of input and output plugs of analog devices. For example, the user may drag a pointer from a desired signal output device (such as VTR 5) to a desired signal input device (such as camera 6) by use of a mouse device which may be included in the remote controller 2 (Fig. 1). Upon dragging the pointer, an image 96 of a cable and an icon 95 indicating a signal input/output direction may be displayed.

An example of an arrangement of an ID-name table in the device name setting section 21 which may be used to obtain a device name from company IDs and chip IDs is illustrated in Fig. 21. The ID-name table may include names of manufacturers corresponding to company IDs and product category names corresponding to chip IDs. The data in this table may have been previously recorded in a memory medium such as EEPROM 17 (Fig. 2) which may be capable of maintaining such data in the absence of a normal power supply. The device

name setting section 21 may temporarily set a device name on the basis of a name read out from the ID-name table. As an example, in the situation in which "1" is read out as a company ID for a newly connected device and "2" is read out as a chip ID for the device, the device name setting section 21 may combine the name "SONY" (corresponding to the company ID "1") and the name "VTR" (corresponding to the chip ID "2") to obtain the name "SONY_VTR" for the device.

To avoid the possibility of providing the same name to different devices, a number may be added after the end of each name letter sequence. For example, if no information (company ID and chip ID) is obtained from a device, the device name setting section 21 may read out the name "DEVICE" from the ID-name table and the user may add "01" to it to obtain "DEVICE01" as the device name. If the same information is read from different devices, the device name setting section 21 may temporarily set a name obtained by adding together a name read out from the ID-name table and a numeral sequence different from numeral sequences already used in device names. For example, in the situation wherein "DEVICE01" and "DEVICE02" have already been used as device names, the device name setting section 21 may automatically set "DEVICE03" temporarily for a newly added device. This setting method may also be used for devices for which company IDs and chip IDs can be read.

The connection manager 1 may be provided with a user interface for changing the contents of the ID-name table and the user interface for changing a device name temporarily set into a different letter sequence as described above. These interfaces enable the user to easily and immediately set a desired device name in the connection manager 1.

As described above, the connection manager 1 enables the user to easily and quickly perform a desired connection setting or settings between a number of information

processing apparatuses connected in a network, whereupon data may be transferred therebetween.

The remote controller 2 may be a mouse or a keyboard or any device which enables a signal formed from a user input to be supplied to the connection manager 1.

Although the connection manager 1 has been described as being a separate device, the present invention is not so limited. Alternatively, the functions of the connection manager may be included within another device (such as VTR 5).

Although various information items have been described as being displayed on the monitor 3, the present invention is not so limited. Alternatively, such items may be displayed on a front panel of the connection manager 1, a display panel of the remote controller 2, or the like.

The results of input/output connection setting performed by the connection manager 1 with respect to the nodes of the network may be displayed on an input/output connection designation graphic interface. The input/output connection designation graphic interface may be formed so that an output plug and an input plug may be repeatedly connected to the limit of IEEE 1394 channels and bands.

Additionally, the connection manager 1 may be adapted to store input/output connection conditions in a memory such as RAM 13 (Fig. 2) at predetermined time intervals or after the occurrence of a predetermined event or the like so as to enable such connection conditions to be restored after the occurrence of a bus reset which may be caused by the connection of an additional device to the bus or the like. That is, after the occurrence of a bus reset, the connection manager may automatically read the stored connection information and perform reconnection processing so as to re-establish the connection conditions which existed before the bus reset.

A computer program for performing the above-described processing may be provided in communication mediums such as those involving a network and a satellite as well in a recording medium such as a magnetic disk, a compact-disk read-only memory (CD-ROM) and a solid state memory.

Therefore, the present invention enables an input/output setting or settings between a number of information processing apparatuses connected to a network to be performed by use of one information processing apparatus. As a result, an input/output setting or settings of apparatuses connected to the network can be performed easily and efficiently. Further, the present invention conforms or operates in accordance with a number of predetermined standards, such as IEEE1394 and IEC61883.

Although preferred embodiments of the present invention and modifications thereof have been described in detail herein, it is to be understood that this invention is not limited to these embodiments and modifications, and that other modifications and variations may be effected by one skilled in the art without departing from the spirit and scope of the invention as defined by the appended claims.

INDUSTRIAL APPLICABILITY

As described above, an information processing apparatus and an information processing method according to this invention respectively are applied to preferably a home network connecting Video Tape Recorder (VTR), an all-in one video system, Hard Disk Drive (HDD) for recording video data and audio data etc. thereto.

CLAIMES

1. An information processing apparatus connected to a network together with a number of other information processing apparatuses, said information processing apparatus comprising:

unique information obtaining means for obtaining unique information of the information processing apparatuses on said network;

connection instruction inputting means for generating signals representative of a user interface for display on a display unit based upon said unique information and for inputting a connection instruction for at least one of said information processing apparatuses; and

connection setting execution means for setting a connection from or to the at least one of said information processing apparatuses based on said connection instruction from said connection instruction inputting means.

2. An information processing apparatus according to claim 1, wherein said network is a bus interface.

3. An information processing apparatus according to claim 1, wherein said information apparatus is an audio/visual apparatus.

4. An information processing apparatus according to claim 2, further comprising self identification (ID) inputting means for inputting self IDs outputted from each of said information processing apparatuses on said network when a bus reset of said network occurs; and

means for obtaining a number of said other apparatuses based upon said self IDs.

5. An information processing apparatus according to claim 4, wherein each of said information processing apparatuses includes storing means for storing at least unique

numbers designating a manufacturer of the respective information processing apparatus, and wherein said unique information obtaining means obtains said at least unique numbers as said unique information from said storing means.

6. An information processing apparatus according to claim 5, further comprising means for obtaining names corresponding to said information processing apparatuses from each of said unique numbers, and wherein said connection instruction inputting means includes means for generating signals representative of said names for display on said display unit.

7. An information processing apparatus according to claim 1, wherein said connection instruction inputting means includes means for generating signals representative of a status of the connection set by said connection setting execution means for display on said display unit.

8. An information processing apparatus according to claim 1, wherein said connection instruction inputting means includes means for generating signals representative of said information processing apparatuses on said network as icons for display on said display unit and means for associating a first one of said icons to a second one of said icons on said display unit in accordance with said connection instruction.

9. An information processing apparatus according to claim 1, further comprising apparatus name setting means for setting names to said information processing apparatuses connected to the network.

10. An information processing apparatus according to claim 1, further comprising format checking means for checking a format of data which can be input or output by a first information processing apparatus or a second information processing apparatus on said network, and wherein said connection setting execution means sets a connection between

said first information processing apparatus and said second information processing apparatus if the format of data which can be output from said first information processing apparatus and the format of data which can be input to said second information processing apparatus are similar.

11. An information processing apparatus according to claim 1, further comprising function checking means for checking whether a respective one or ones of said information processing apparatuses on said network has a predetermined data transmission function.

12. An information processing apparatus according to claim 11, wherein the information processing apparatuses with said predetermined data transmission function have predetermined data stored in storing means, and wherein said function checking means checks whether the respective one or ones of said information processing apparatuses have said predetermined data.

13. An information processing apparatus according to claim 1, further comprising connection status storing means for storing connection status of said network before a bus reset on the network, and wherein said connection setting executing means sets a connection based upon said connection status in said connection status storing means after said bus reset.

14. An information processing apparatus according to claim 1, wherein said connection setting execution means sets at least two connections between a first information processing apparatus and a second information processing apparatus in accordance with a respective connection instruction from said connection instruction inputting means corresponding to a connection arrangement between said first information processing apparatus and said second information processing apparatus.

15. A connection establishing method for an information processing apparatus connected to a network together with a number of other information processing apparatuses, said method comprising the steps of:

obtaining unique information of the information processing apparatuses on said network;

displaying a user interface based upon said unique information;

inputting a connection instruction for at least one of said information processing apparatuses; and

setting a connection from or to the at least one of said information processing apparatuses based on said connection instruction.

16. A connection establishing method according to claim 15, wherein said network is a bus interface.

17. An connection establishing method according to claim 15, wherein said information apparatus is an audio/visual apparatus.

18. A connection establishing method according to claim 15, further comprising the steps of inputting self identifications (IDs) outputted from each of said information processing apparatuses when a bus reset of said network occurs, and obtaining a number of said information processing apparatuses based upon said self IDs.

19. A connection establishing method according to claim 18, wherein each of said information processing apparatuses includes storing means for storing at least unique numbers designating a manufacturer of the respective information processing apparatuses, and wherein said step of obtaining unique information obtains said at least unique numbers as said unique information from said storing means.

20. A connection establishing method according to claim 19, further comprising the step of obtaining names corresponding to said information processing apparatuses from each of said unique numbers, and wherein said step of displaying a user interface includes displaying said names.

21. A connection establishing method according to claim 15, further comprising the step of displaying connecting status of said network.

22. A connection establishing method according to claim 15, wherein said step of displaying a user interface includes displaying each of said information processing apparatuses on said network as an icon, and wherein the step of inputting a connection instruction includes associating a first one of said icons to a second one of said icons.

23. A connection establishing method according to claim 15, further comprising the step of setting names to said information processing apparatuses on the network.

24. A connection establishing method according to claim 15, further comprising the step of checking a format of data which can be input or output by a first information processing apparatus or a second information processing apparatus on said network, and wherein the setting step sets a connection between said first information processing apparatus and said second information processing apparatus if the format of data which can be output from said first information processing apparatus and the format of data which can be input to said second information processing apparatus are similar.

25. A connection establishing method according to claim 15, further comprising the step of checking whether a respective one or ones of said information processing apparatuses on said network has a predetermined data transmission function.

26. A connection establishing according to claim 25, wherein the information processing apparatuses with said predetermined data transmission function have predetermined

data stored in storing means, and wherein the checking step checks whether the respective one or ones of said information processing apparatus have said predetermined data.

27. A connection establishing method according to claim 15, further comprising the step of storing connection status of said network before a bus reset on said network, and wherein the setting step sets a connection based upon the stored connection status after said bus reset.

28. A connection establishing method according to claim 15, wherein the setting step sets at least two connections between a first information processing apparatus and a second information processing apparatus on said network in accordance with a respective connection instruction for a connection between said first information processing apparatus and said second information processing apparatus.

29. An information processing apparatus adapted to be connected to a digital bus to which first and second information processing apparatuses are connected, in which a connection has not been established between the first information processing apparatus and the second information processing apparatus, said apparatus comprising:

connection instruction inputting means for inputting a connection instruction representative of a connection between the first information processing apparatus and the second information processing apparatus on said bus; and

connection setting means for outputting a control signal of said connection instruction to said first information processing apparatus and said second information processing apparatus and for establishing a connection between said first information processing apparatus and said second information processing apparatus.

30. An information processing apparatus according to claim 29, further comprising format checking means for checking a format of data which can be input or output

by said first information processing apparatus or said second information processing apparatus, and wherein said connection setting means sets said connection between said first information processing apparatus and said second information processing apparatus if the format of data which can be output from said first information processing apparatus and the format of data which can be input to said second information processing apparatus are similar.

31. An information processing apparatus according to claim 29, further comprising function checking means for checking whether a respective one or ones of the information processing apparatuses on said bus has a predetermined data transmission function.

32. An information processing apparatus according to claim 31, wherein the information processing apparatuses on said bus with said predetermined data transmission function have predetermined data stored in storing means, and wherein said function checking means checks whether the respective one or ones of the information processing apparatuses have said predetermined data.

33. An information processing apparatus according to claim 29, further comprising connection status storing means for storing a status of said connection between said first information processing apparatus and said second information processing apparatus before a bus reset on said bus, and wherein said connection setting means sets a connection based upon said status in said connection status storing means after said bus reset.

34. An information processing apparatus according to claim 29, wherein said connection setting means establishes at least two connections between said first information processing apparatus and said second information processing apparatus.

35. A connection establishing method for an information processing apparatus adapted to be connected to a digital bus to which first and second information processing apparatuses are connected, in which a connection has not been established between the first

information processing apparatus and the second information processing apparatus, said method comprising the step of:

inputting a connection instruction representative of a connection between the first information processing apparatus and the second information apparatus information processing apparatus on said bus; and

establishing said connection by outputting a control signal of said connection instruction to said first information processing apparatus and said second information processing apparatus.

36. A connection establishing method according to claim 35, further comprising the step of checking a format of data which can be input or output by said first information processing apparatus or said second information processing apparatus, and wherein the setting step sets said connection if the format of data which can be output from said first information processing apparatus and the format of data which can be input to said second information processing apparatus are similar.

37. A connection establishing method according to claim 35, further comprising the step of checking weather a respective one or ones of the information processing apparatuses on said bus has a predetermined data transmission function.

38. A connection establishing method according to claim 37, wherein the information processing apparatuses on said bus with said predetermined data transmission function have predetermined data stored in storing means, and wherein the checking step checks whether the respective one or ones of the information processing apparatus have said predetermined data.

39. A connection establishing method according to claim 35, further comprising the step of storing a status of said connection between said first information apparatus and said

second information apparatus before a bus reset on said bus, and wherein the setting step sets a connection based upon said status after said bus reset.

40. A connection establishing method according to claim 35, wherein the setting step sets at least two connections between said first information processing apparatus and said second information processing apparatus.

41. An information processing apparatus according to claim 1, wherein said bus interface is an IEEE 1394 bus interface.

42. A connection establishing method according to claim 16, wherein said bus interface is an IEEE 1394 bus interface.

43. An apparatus for connecting a number of information processing apparatuses together in a desired manner in which each information processing apparatus is connected to a digital bus, said apparatus comprising:

means for generating a signal representative of a graphical interface for display on a display unit which indicates any available connections between the information processing apparatuses connected to said digital bus;

means for receiving signals from a user indicative of a desired connection selected from among the available connections indicated on said graphical interface and for forming a control signal therefrom; and

means for generating a signal for causing the desired connection between the corresponding information processing apparatuses to be established in accordance with said control signal.

44. An apparatus according to claim 43, wherein said digital bus is an IEEE 1394 bus.

45. An apparatus according to claim 43, wherein the graphical interface further indicates a non-available connection or connections between the information processing apparatuses connected to said digital bus.

46. An apparatus according to claim 43, wherein the graphical interface has a matrix-like arrangement of rows and columns so as to form a plurality of cells in which the information processing apparatuses connected to said digital bus are identified in a row and a column and in which the available connections are identifiable from the cell or cells corresponding thereto.

47. A method for connecting a number of information processing apparatuses together in a desired manner in which each information processing apparatus is connected to a digital bus, said method comprising the steps of:

generating a signal representative of a graphical interface for display on a display unit which indicates any available connections between the information processing apparatuses connected to said digital bus;

receiving signals from a user indicative of a desired connection selected from among the available connections indicated on said graphical interface and forming a control signal therefrom; and

generating a signal for causing the desired connection between the corresponding information processing apparatuses to be established in accordance with said control signal.

48. A method according to claim 47, wherein said digital bus is an IEEE 1394 bus.

49. A method according to claim 47, wherein the graphical interface further indicates a non-available connection or connections between the information processing apparatuses connected to said digital bus.

50. A method according to claim 47, wherein the graphical interface has a matrix-like arrangement of rows and columns so as to form a plurality of cells in which the information processing apparatuses connected to said digital bus are identified in a row and a column and in which the available connections are identifiable from the cell or cells corresponding thereto.

51. An apparatus for connecting a number of information processing apparatuses together in a desired manner in which each information processing apparatus is connected to a digital bus, said apparatus comprising:

means for generating a signal representative of a graphical interface for display on a display unit which indicates the information processing apparatuses connected to said digital bus;

means for receiving a desired connection signal indicative of a desired connection between corresponding information processing apparatuses and for forming a control signal therefrom, in which the desired connection signal is obtained from an input provided by a user with the use of said graphical interface; and

means for generating a signal for causing the desired connection between the corresponding information processing apparatuses to be established in accordance with said control signal.

52. An apparatus according to claim 51, wherein said digital bus is an IEEE 1394 bus.

53. A method for connecting a number of information processing apparatuses together in a desired manner in which each information processing apparatus is connected to a digital bus, said method comprising the steps of:

generating a signal representative of a graphical interface for display on a display unit which indicates the information processing apparatuses connected to said digital bus;

receiving a desired connection signal indicative of a desired connection between corresponding information processing apparatuses and forming a control signal therefrom, in which the desired connection signal is obtained from an input provided by a user with the use of said graphical interface; and

generating a signal for causing the desired connection between the corresponding information processing apparatuses to be established in accordance with said control signal.

54. A method according to claim 53, wherein said digital bus is an IEEE 1394 bus.

FIG. 1

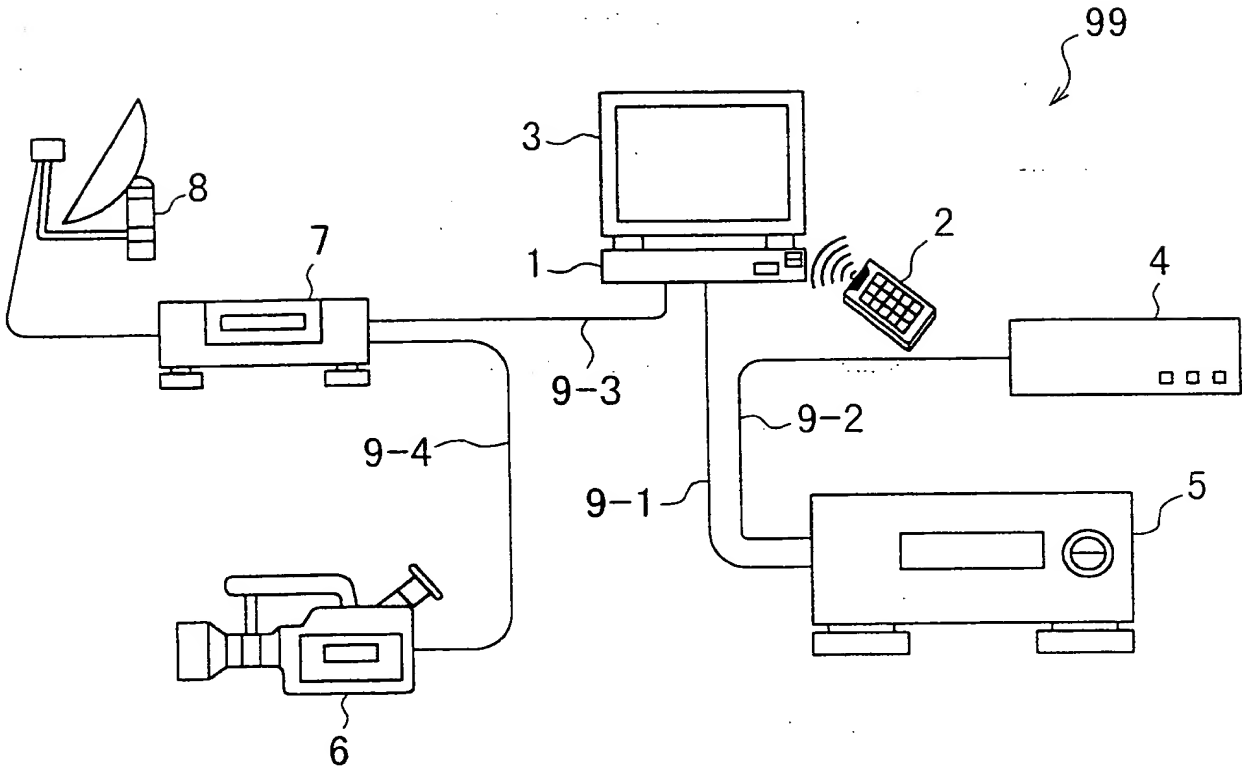


FIG. 2

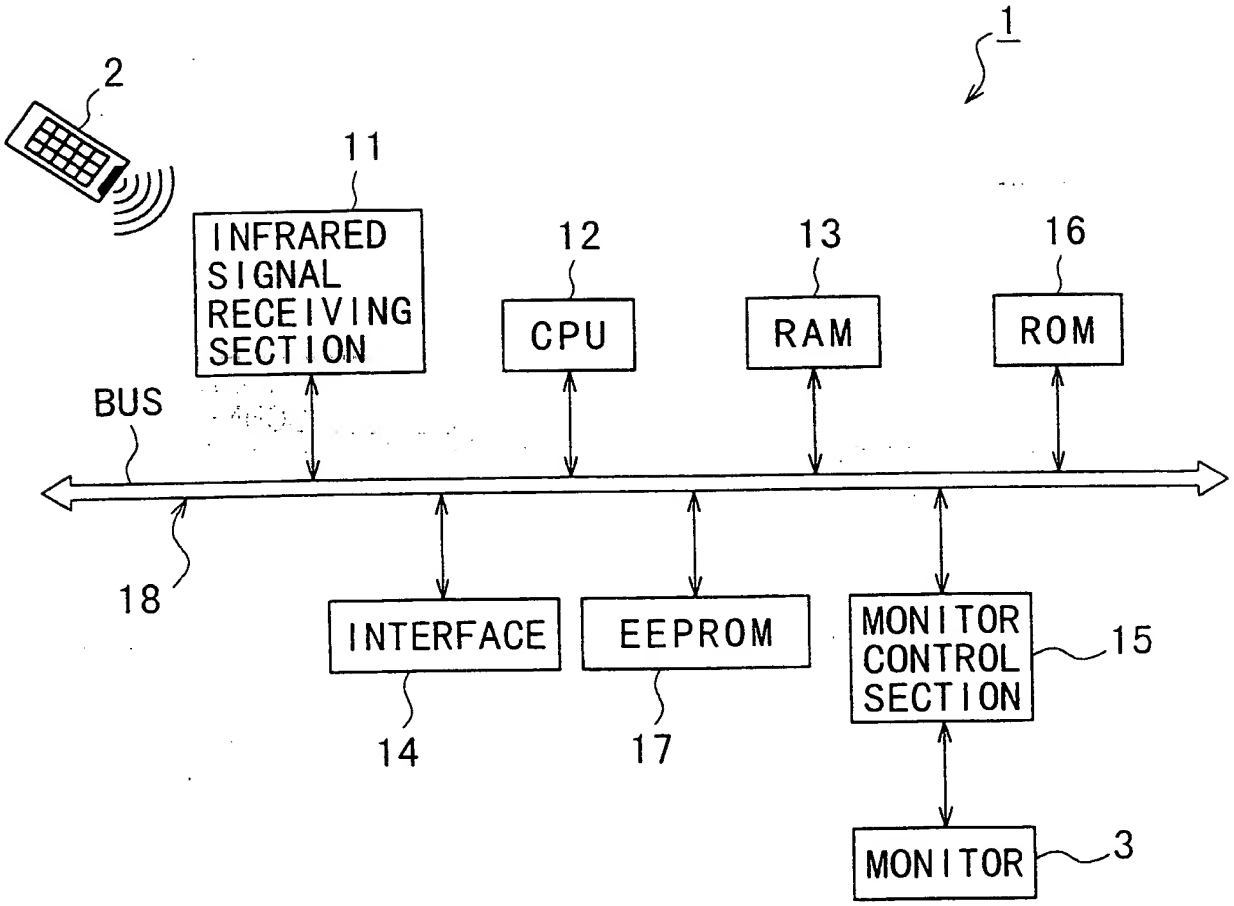

1
2
11
INFRARED SIGNAL RECEIVING SECTION
12
CPU
13
RAM
16
ROM
BUS
18
INTERFACE
14
EEPROM
17
MONITOR CONTROL SECTION
15
MONITOR
3

FIG. 3

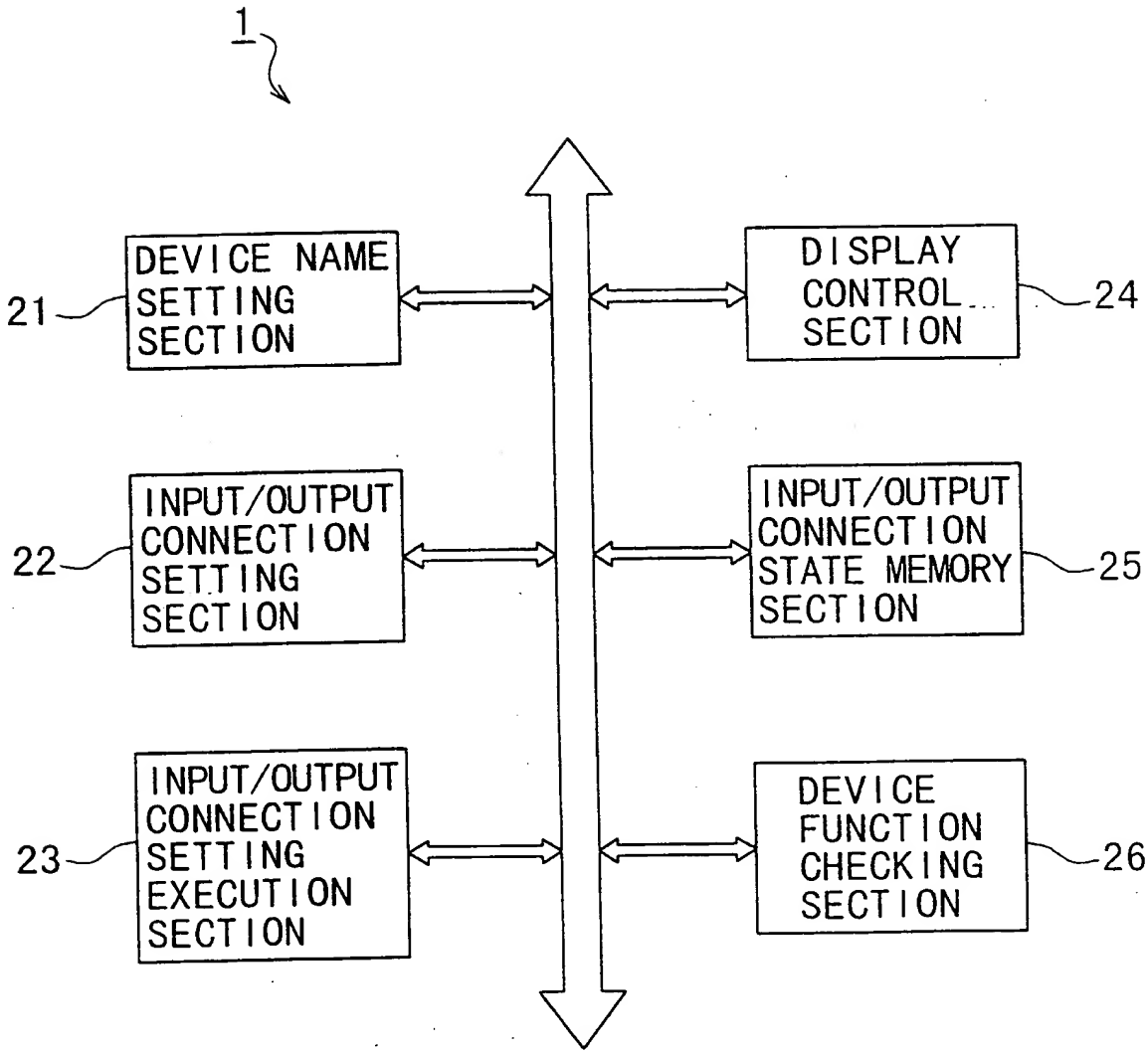

1
DEVICE NAME SETTING SECTION
21
INPUT/OUTPUT CONNECTION SETTING SECTION
22
INPUT/OUTPUT CONNECTION SETTING EXECUTION SECTION
23
DISPLAY CONTROL SECTION
24
INPUT/OUTPUT CONNECTION STATE MEMORY SECTION
25
DEVICE FUNCTION CHECKING SECTION
26

FIG. 4

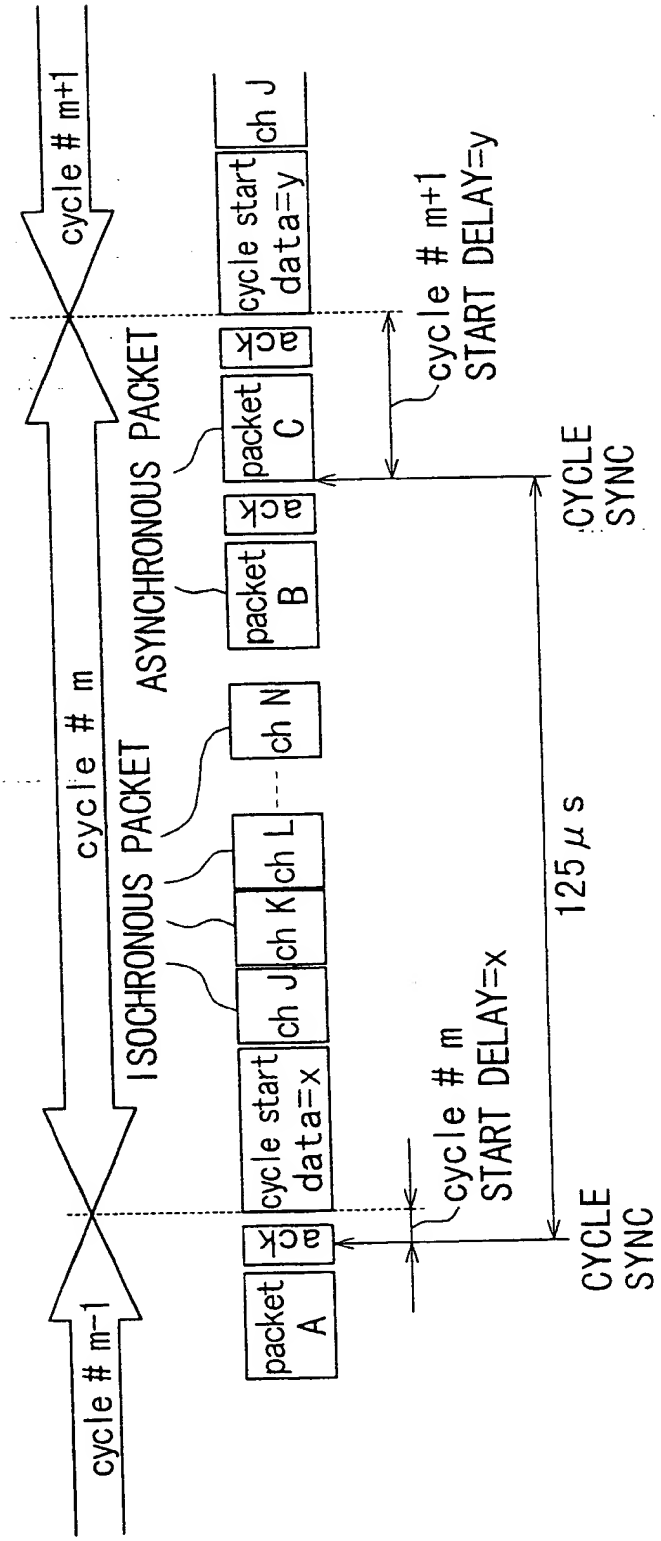

cycle # m-1
cycle # m
cycle # m+1
ISOCHRONOUS PACKET
ASYNCHRONOUS PACKET
packet A
GAP
cycle start data=x
ch J
ch K
ch L
ch N
packet B
packet C
cycle start data=y
ch J
cycle # m START DELAY=x
cycle # m+1 START DELAY=y
125 μs
CYCLE SYNC
CYCLE SYNC

FIG. 5

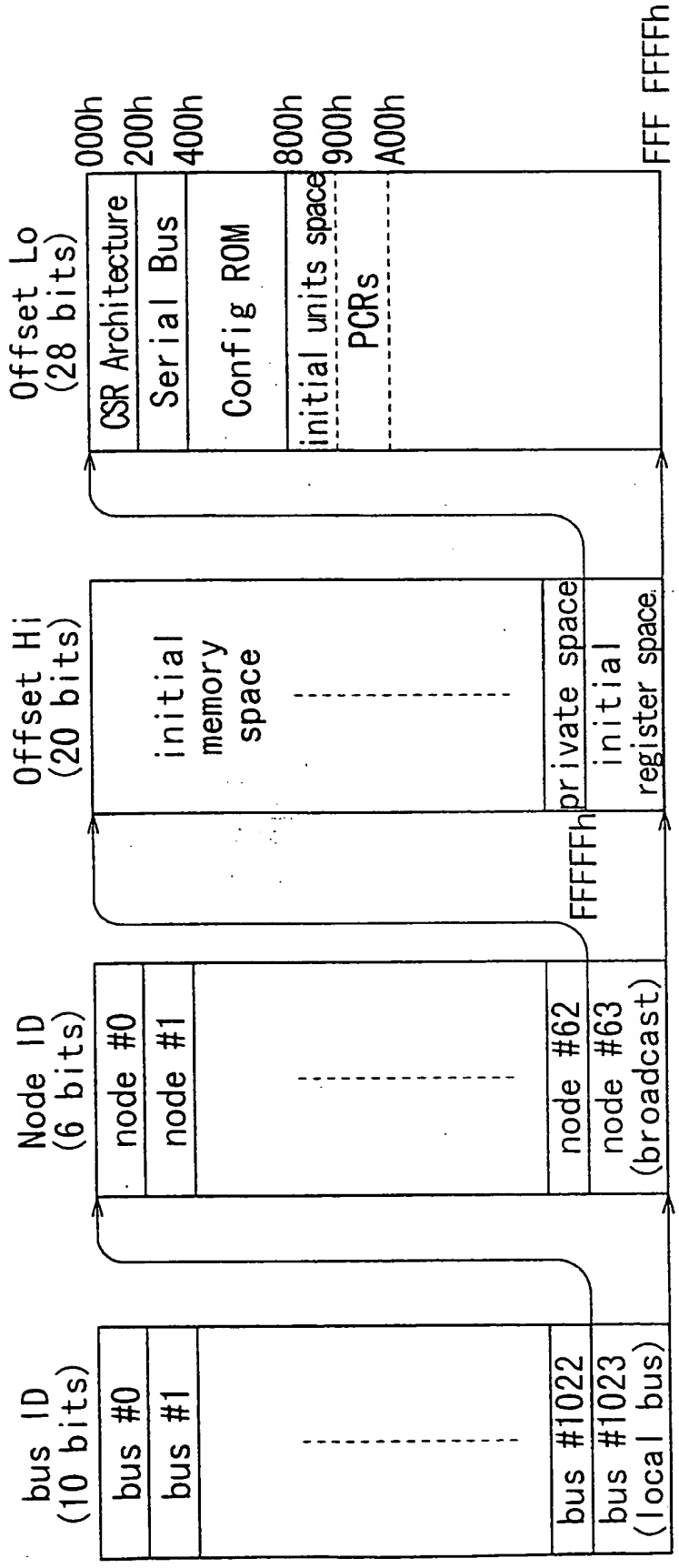
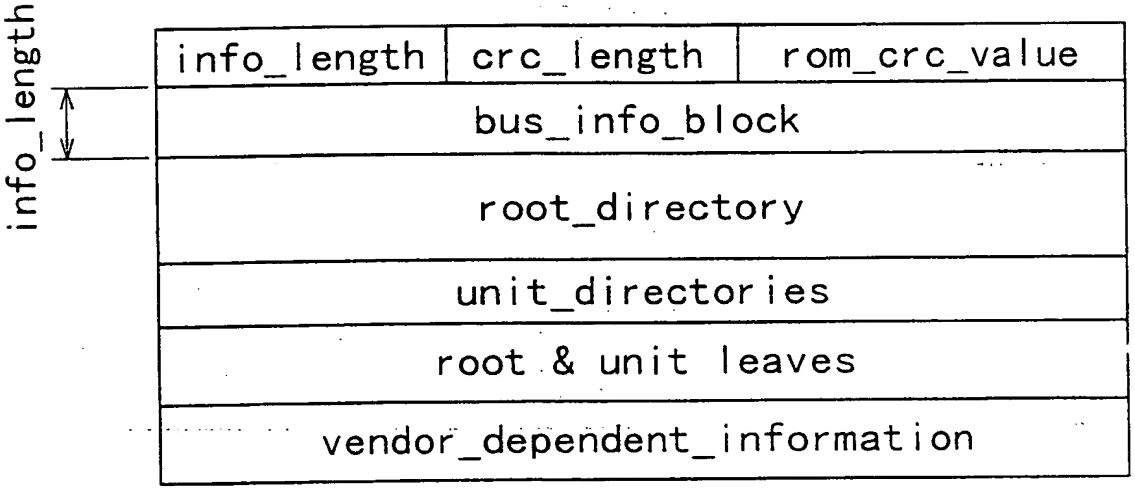

bus ID
(10 bits)
bus #0
bus #1
bus #1022
bus #1023
(local bus)
Node ID
(6 bits)
node #0
node #1
node #62
node #63
(broadcast)
FFFFFh
Offset Hi
(20 bits)
initial
memory
space
private space
initial
register space
Offset Lo
(28 bits)
CSR Architecture
Serial Bus
Config ROM
initial units space
PCRs
000h
200h
400h
800h
900h
A00h
FFF FFFFh

FIG. 6

OFFSET	NAME	FUNCTION
000h	STATE_CLEAR	STATE AND CONTROL INFORMATION
004h	STATE_SET	SETTING STATE_CLEAR BIT
008h	NODE_IDs	INDICATING 16-BIT NODE ID
00Ch	RESET_START	STARTING COMMAND RESET
018h-01Ch	SPLIT_TIMEOUT	PRESCRIBING MAXIMUM TIME OF SPLITS
200h	CYCLE_TIME	CTCLE TIME
210h	BUSY_TIMEOUT	PRESCRIBING LIMITATION ON RETRY
21Ch	BUS_MANAGER	INDICATING ID OF BUS MANAGER
220h	BANDWIDTH_AVAILABLE	INDICATING BAND ASSIGNABLE TO ISOCHRONOUS COMMUNICATION
224h-228h	CHANNELS_AVAILABLE	INDICATING STATE OF USE OF EACH CHANNEL

FIG. 7


info_length
info_length
crc_length
rom_crc_value
bus_info_block
root_directory
unit_directories
root & unit leaves
vendor_dependent_information

F I G. 8

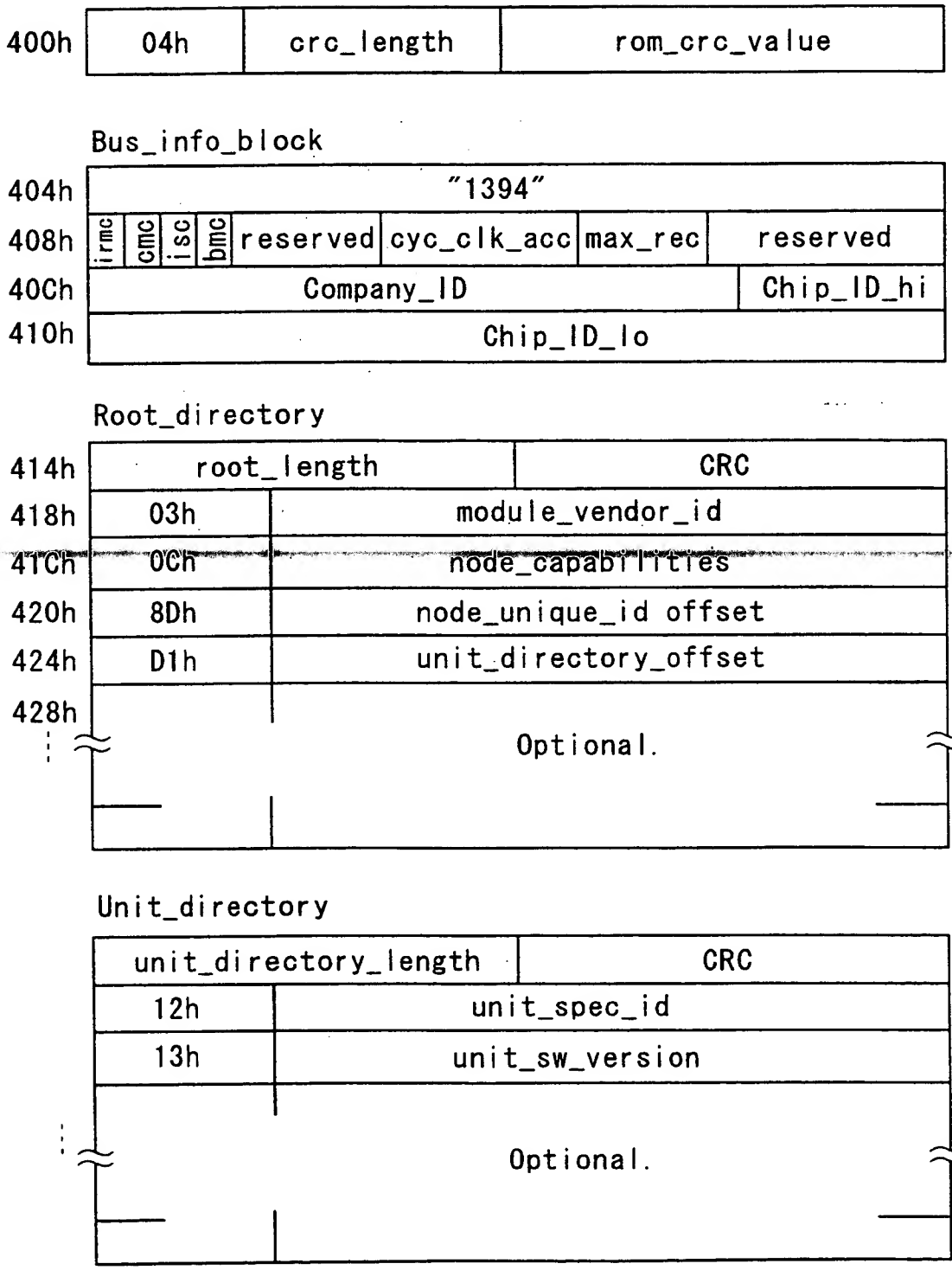

400h
04h
crc_length
rom_crc_value
Bus_info_block
404h
"1394"
408h
irmc
cmc
isc
bmc
reserved
cyc_clk_acc
max_rec
reserved
40Ch
Company_ID
Chip_ID_hi
410h
Chip_ID_lo
Root_directory
414h
root_length
CRC
418h
03h
module_vendor_id
41Ch
0Ch
node_capabilities
420h
8Dh
node_unique_id offset
424h
D1h
unit_directory_offset
428h
Optional.
Unit_directory
unit_directory_length
CRC
12h
unit_spec_id
13h
unit_sw_version
Optional.

FIG. 9

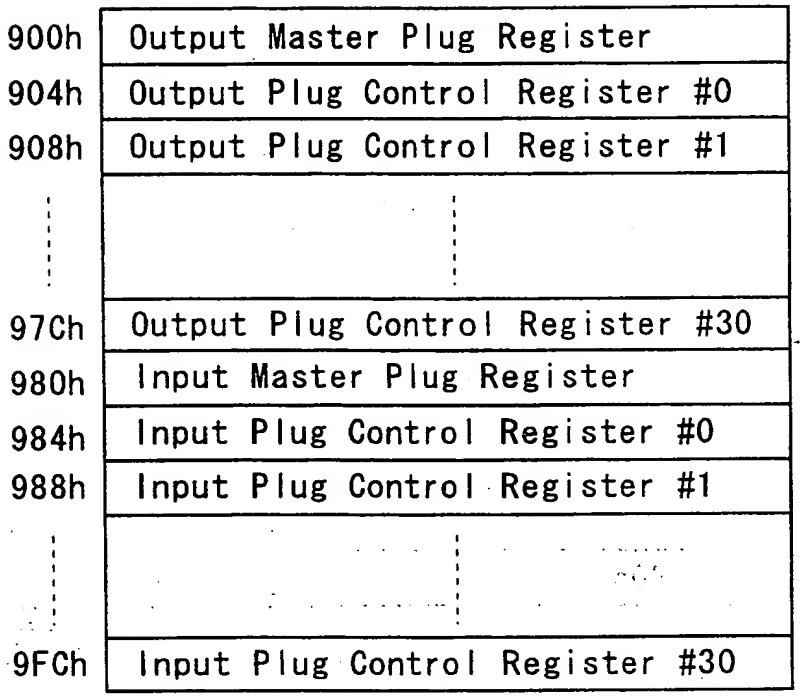

900h
Output Master Plug Register
904h
Output Plug Control Register #0
908h
Output Plug Control Register #1
97Ch
Output Plug Control Register #30
980h
Input Master Plug Register
984h
Input Plug Control Register #0
988h
Input Plug Control Register #1
9FCh
Input Plug Control Register #30

FIG. 10A

oMPR

data rate capability	broadcast channel base	non-persistent extension field	persistent extension field	reserved	number of output plugs
2	6	8	8	3	5 (bit)

FIG. 10B

oPCR[n]

on-line	broadcast connection counter	point-to-point connection counter	reserved	channel number	data rate	overhead ID	payload
1	1	6	2	6	2	4	10 (bit)

FIG. 10C

iMPR

data rate capability	reserved	non-persistent extension field	persistent extension field	reserved	number of input plugs
2	6	8	8	3	5 (bit)

FIG. 10D

iPCR[n]

on-line	broadcast connection counter	point-to-point connection counter	reserved	channel number	reserved
1	1	6	2	6	16 (bit)

FIG. 11

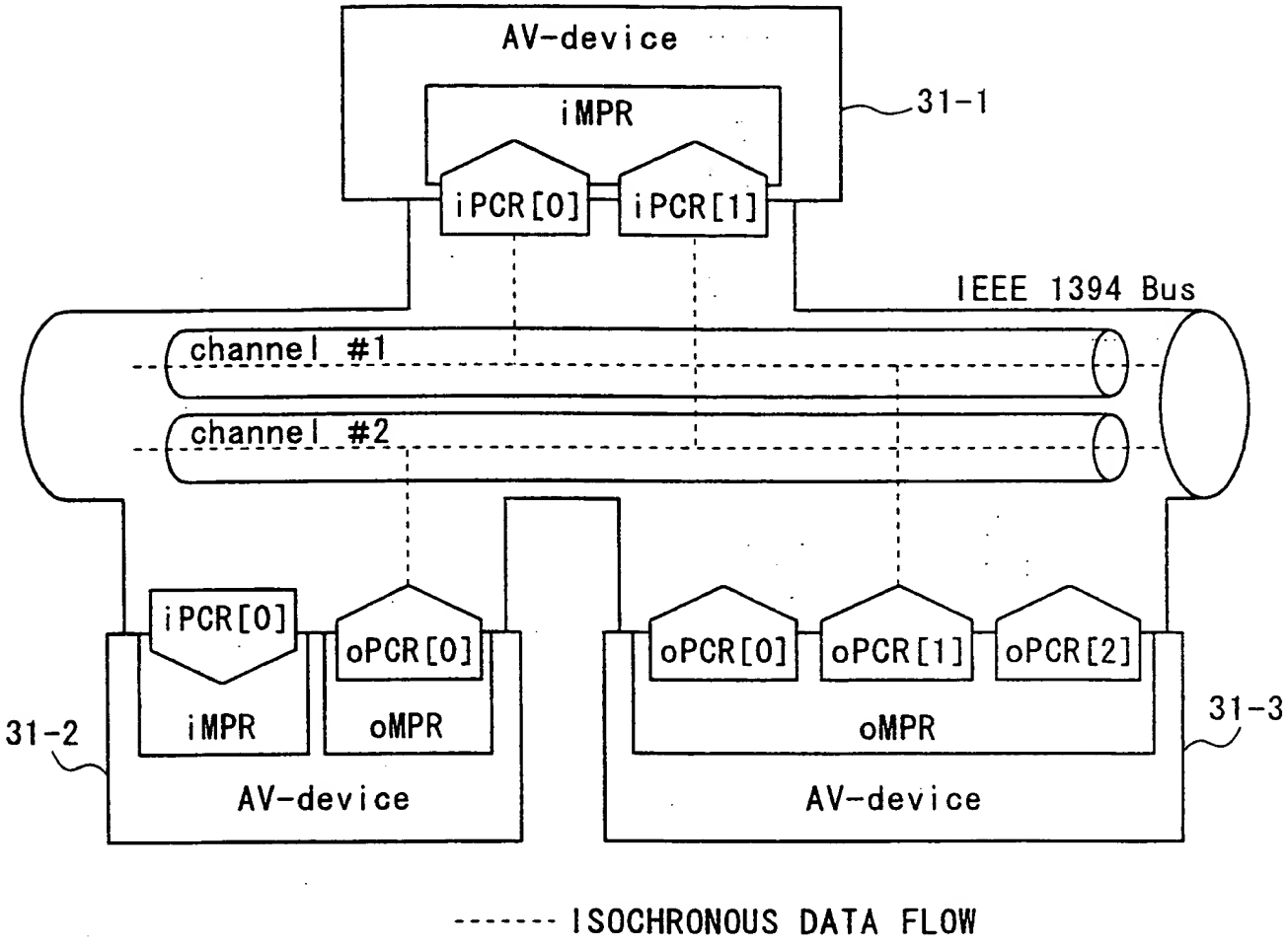

AV-device
iMPR
31-1
iPCR[0]
iPCR[1]
IEEE 1394 Bus
channel #1
channel #2
iPCR[0]
oPCR[0]
oPCR[0]
oPCR[1]
oPCR[2]
31-2
iMPR
oMPR
oMPR
31-3
AV-device
AV-device
------- ISOCHRONOUS DATA FLOW

FIG. 12

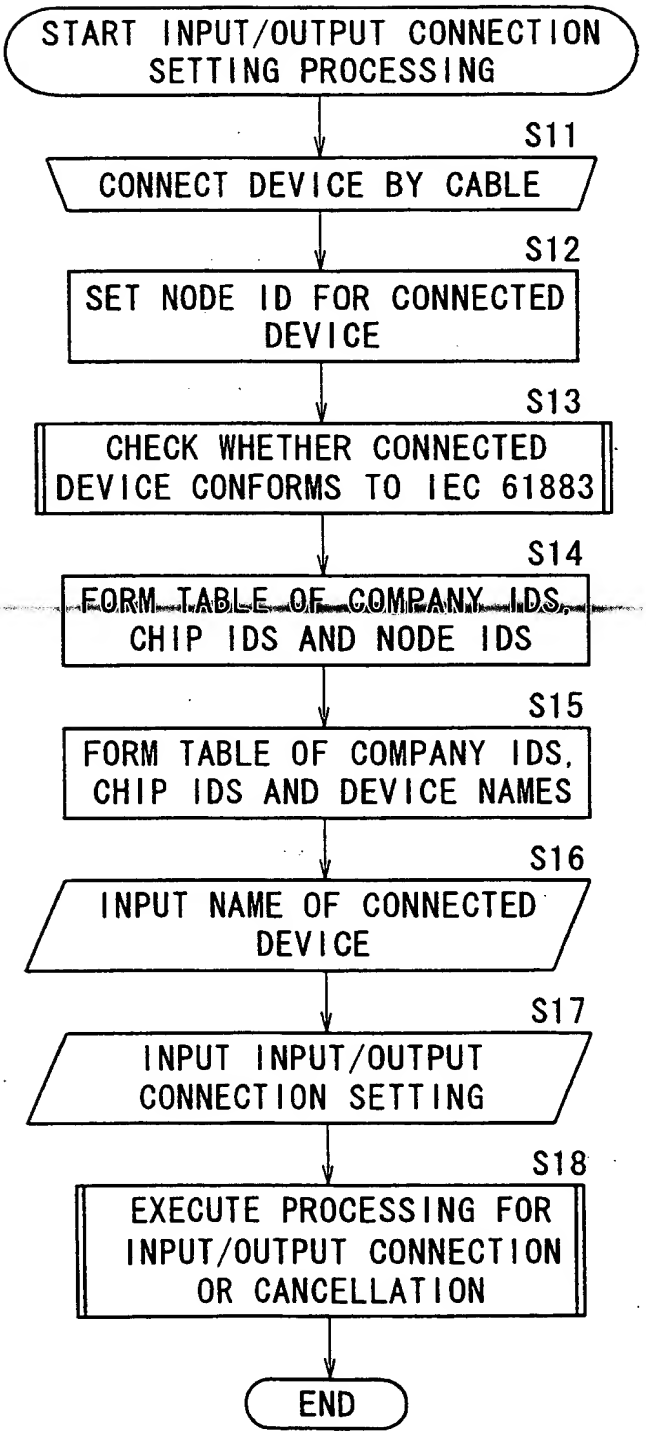

START INPUT/OUTPUT CONNECTION SETTING PROCESSING
S11
CONNECT DEVICE BY CABLE
S12
SET NODE ID FOR CONNECTED DEVICE
S13
CHECK WHETHER CONNECTED DEVICE CONFORMS TO IEC 61883
S14
FORM TABLE OF COMPANY IDS, CHIP IDS AND NODE IDS
S15
FORM TABLE OF COMPANY IDS, CHIP IDS AND DEVICE NAMES
S16
INPUT NAME OF CONNECTED DEVICE
S17
INPUT INPUT/OUTPUT CONNECTION SETTING
S18
EXECUTE PROCESSING FOR INPUT/OUTPUT CONNECTION OR CANCELLATION
END

FIG. 13

DEVICE NAME	Company ID 3 BYTES	Chip ID 5 BYTES
CAM	00 01 02	03 04 05 06 07
SET TOP BOX	03 04 05	:
VTR	:	:
HDD	:	:
CONNECTION MANAGER	:	:

FIG. 14

Company ID 3 BYTES	Chip ID 5 BYTES	Node ID
00 01 02	03 04 05 06 07	0
03 04 05	:	1
:	:	2
:	:	3
:	:	4
:	:	5

FIG. 15

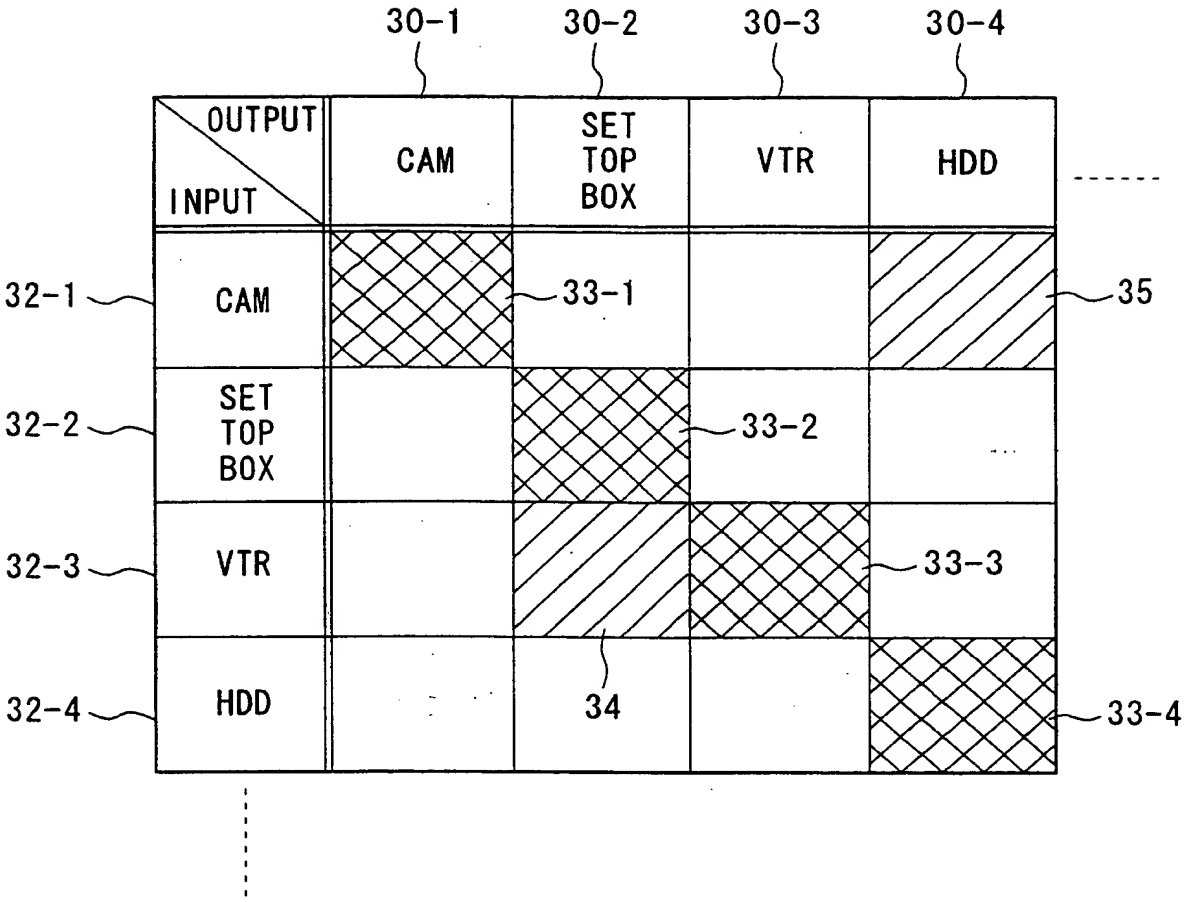

30-1
30-2
30-3
30-4
OUTPUT
INPUT
CAM
SET TOP BOX
VTR
HDD
32-1
32-2
32-3
32-4
33-1
33-2
33-3
33-4
34
35

FIG. 16

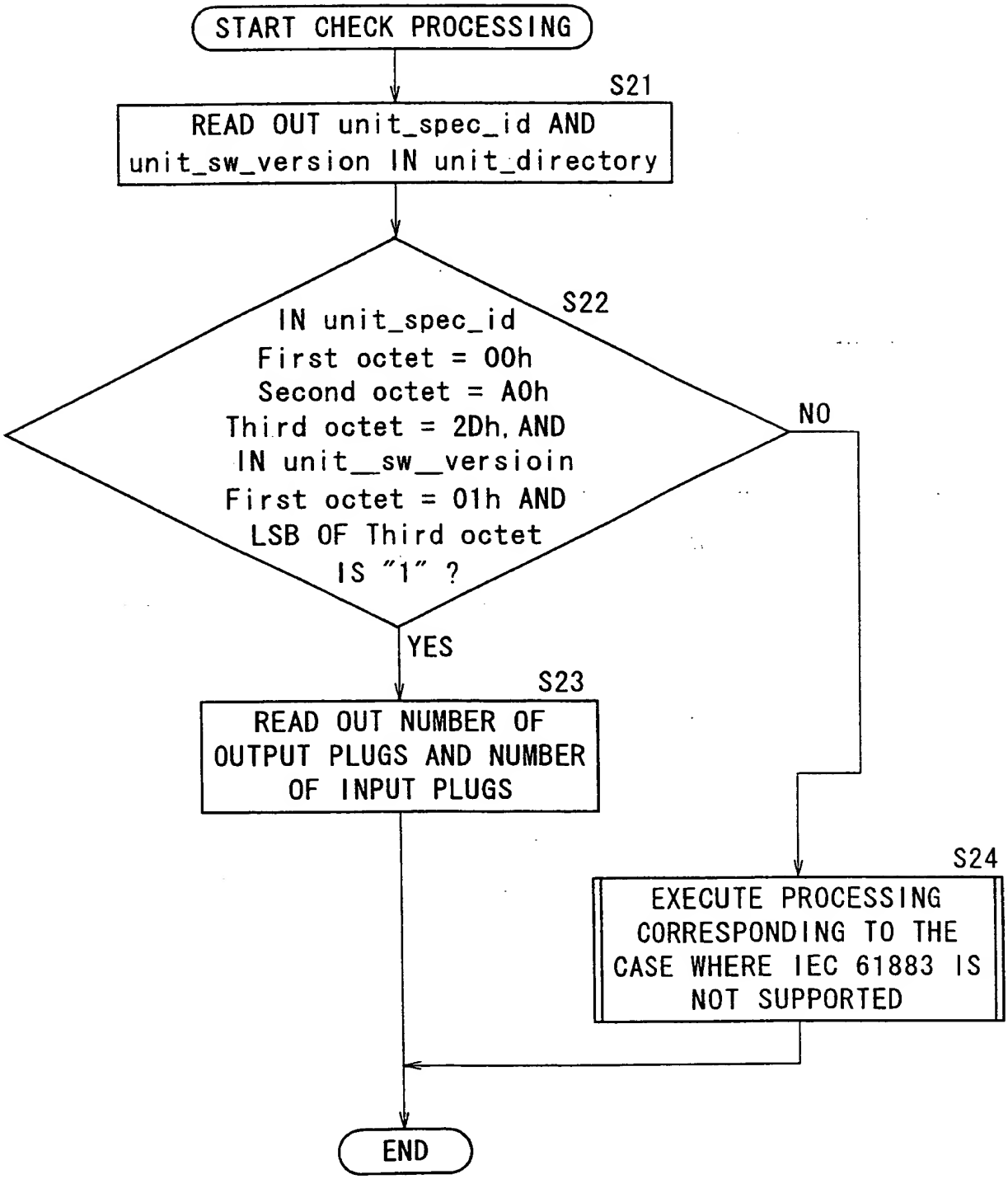

START CHECK PROCESSING
S21
READ OUT unit_spec_id AND unit_sw_version IN unit_directory
S22
IN unit_spec_id First octet = 00h Second octet = A0h Third octet = 2Dh, AND IN unit__sw__versioin First octet = 01h AND LSB OF Third octet IS "1" ?
NO
YES
S23
READ OUT NUMBER OF OUTPUT PLUGS AND NUMBER OF INPUT PLUGS
S24
EXECUTE PROCESSING CORRESPONDING TO THE CASE WHERE IEC 61883 IS NOT SUPPORTED
END

FIG. 17

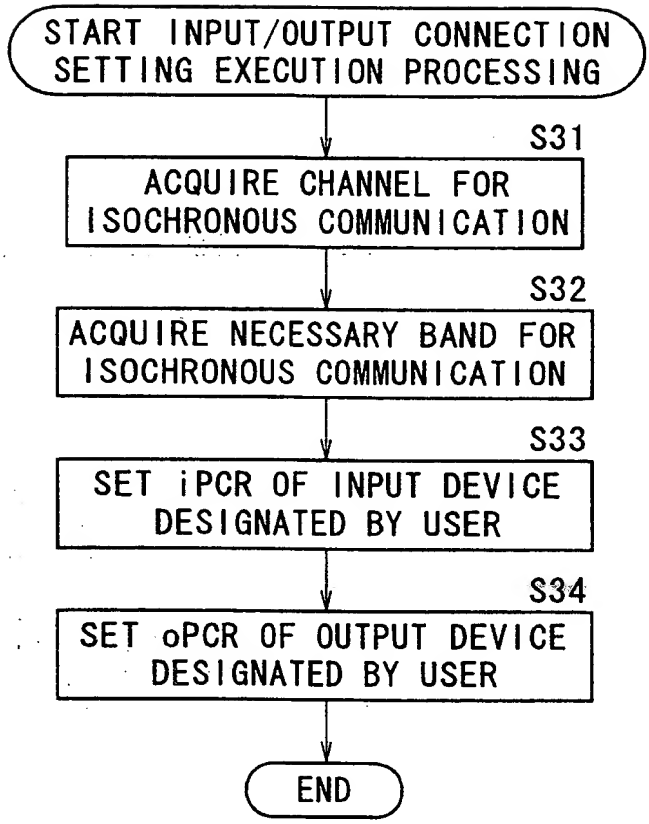

START INPUT/OUTPUT CONNECTION SETTING EXECUTION PROCESSING
S31
ACQUIRE CHANNEL FOR ISOCHRONOUS COMMUNICATION
S32
ACQUIRE NECESSARY BAND FOR ISOCHRONOUS COMMUNICATION
S33
SET iPCR OF INPUT DEVICE DESIGNATED BY USER
S34
SET oPCR OF OUTPUT DEVICE DESIGNATED BY USER
END

FIG. 18

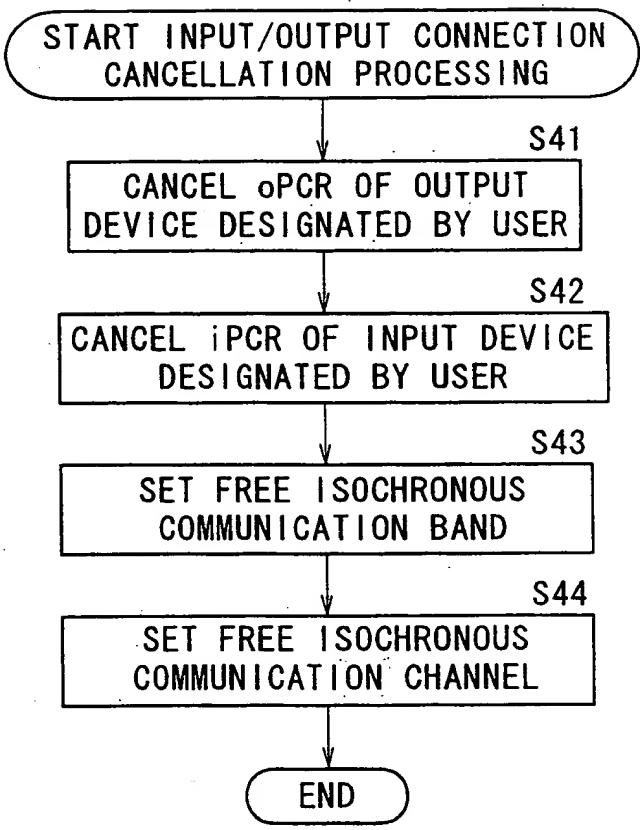

START INPUT/OUTPUT CONNECTION CANCELLATION PROCESSING
S41
CANCEL oPCR OF OUTPUT DEVICE DESIGNATED BY USER
S42
CANCEL iPCR OF INPUT DEVICE DESIGNATED BY USER
S43
SET FREE ISOCHRONOUS COMMUNICATION BAND
S44
SET FREE ISOCHRONOUS COMMUNICATION CHANNEL
END

FIG. 19

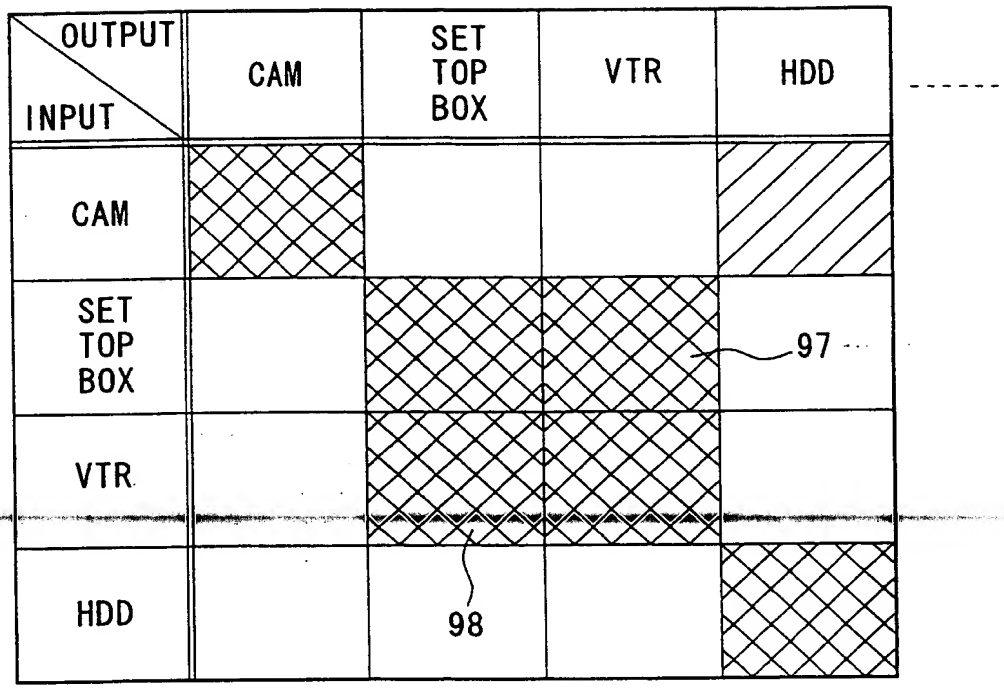

OUTPUT
INPUT
CAM
SET TOP BOX
VTR
HDD
CAM
SET TOP BOX
VTR
HDD
97
98

FIG. 20

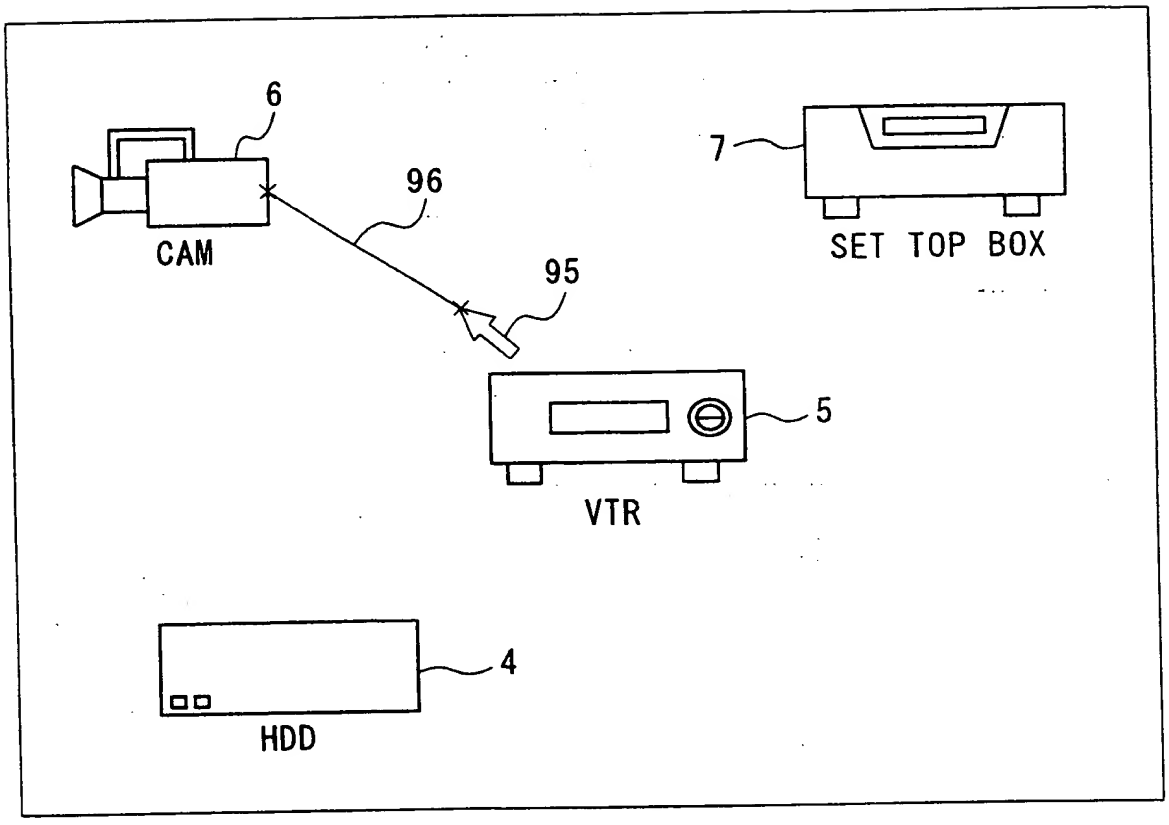


FIG. 21

INFORMATION SORTING	INFORMATION READ FROM DEVICES	NAME
———	———	DEVICE
Company ID	1	SONY
	2	SGE
	3	SME
	:	:
Chip ID	1	CAM
	2	VTR
	3	HDD
	:	:

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 99/02454

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L29/06 H04L12/40 G06F15/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	EP 0 859 322 A (SONY CORP) 19 August 1998 (1998-08-19) abstract column 2, line 44 -column 8, line 1 column 15, line 38 -column 16, line 11 --- -/--	1-54

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
11 October 1999	18/10/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 99/02454

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropnate, of the relevant passages	Relevant to claim No.
X	WICKELGREN I J: "THE FACTS ABOUT FIREWIRE" IEEE SPECTRUM, vol. 34, no. 4, 1 April 1997 (1997-04-01), pages 19-25, XP002051393 ISSN: 0018-9235 figure 1 page 20, left-hand column, line 1 - line 39 page 20, middle column, line 20 - line 35 page 22, right-hand column, line 20 - line 54 page 25, right-hand column, line 11 - line 27 -----	1-54

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/JP 99/02454

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0859322 A	19-08-1998	JP 10228440 A	25-08-1998